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DRAWINGS ATTACHED

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(19)

(54) PRODUCTION OF COATED ROADSTONE

(71) I, FRANZ TUNKL, a citizen of the Federal Republic of Germany, of 20 Bachstrasse, 69 Heidelberg, Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to coated roadstone which is produced by hot mixing aggregate material, graded and proportioned to desired specification, with a suitable quantity of bituminous binder to coat the aggregate material.

Hitherto, it has been the standard practice, accepted as being necessary in the production process, to dry the aggregate material prior to mixing with the binder. Accordingly, the aggregate material (for example ballast, chippings and/or sand, having a water content of about 3 to 5% by weight, possibly with a suitable addition of filler material of grain size below 0.09 mm.) is dried by heating in a dryer with a current of air, whereafter the dried aggregate material is mixed in the hot condition with bituminous binder, for example a bitumen emulsion or liquefied bitumen, to produce the coated roadstone ready for use.

However, the practice referred to has serious disadvantageous consequences. The drying of the aggregate releases dust and fines which are carried away with the current of drying air. Thus not only would initial proportioning and composition of the aggregate material be upset, but particularly those constituents would disappear which are required for filling voids between the coarser constituents to ensure a dense and stable road surface when the coated roadstone is laid Moreover, there is, of course the considerable problem of dust pollution and effective compliance with official regulations regarding such industrial emissions It is therefore necessary as well for recovery of fines from the drying air in order to return them again to the dried aggregate material, as for compliance with regulations, to install relatively expensive equipment such as cyclone separators for the collection of entrained dust and fines emitted from the dryer.

An object of this invention is to provide an improved method of producing coated roadstone which avoids the described disadvantages of current practice.

According to the invention there is provided a process for producing coated roadstone which comprises heating and mixing an aggregate material having a water content and a solid bituminous binder in particulate or granular form and proportioned to provide a composition requisite for a mix of coated roadstone to be produced, the water content being removed by evaporation at the same time as the binder is liquefied and coats the aggregate, and the dusty constituents of the aggregate material being retained until such time as they are bound into the mix by the liquefied binder.

The process may be carried out as a two-stage process, of which the first stage is the preparation of a cold mix of aggregate material having a water content and solid binder, which may be regarded as an intermediate product, and the second is the conversion of the cold mix to obtain the coated roadstone. The whole process can, but need not be, carried out at one and the same time and place, that is to say, in a plant in which the cold mix is prepared and then immediately processed to form coated roadstone ready for use. The cold mix can be manufactured independently at one location, for subsequent conversion to coated roadstone at another. The manufactured cold mix can be stored, and can be drawn from stock and transported to where it is required, and there converted by heating and mixing into coated roadstone ready for use.

As compared with the considerable emissions of dust that attend the conventional process for producing coated roadstone, the described method according to this invention is virtually dustless. In the preparation of the cold mix from aggregate material, the mixing of the aggregate material in cold condition as well as the presence of its water content prevents release of dust to any significant extent. In the conversion of the cold mix into coated roadstone the water present in the aggregate material is evaporated by the heating but at the same time the liquefied binder is coating the aggregate material, so that dusty constituents of the latter are practically completely bound and prevented from being carried away with the heated air and water vapour.

It will be appreciated from the foregoing description of the invention that in order to prepare a cold mix for conversion simply by heating and mixing into coated roadstone of a desired specification, the aggregate raw material used will be correctly graded, proportioned and check-weighed and the correct proportion of bituminous binder added, to suit the desired specification of coated roadstone; also that, since the aggregate material used has a water content, the latter has to be taken into account in proportioning the different grades of aggregate material, and therefore measurements should be taken to determine the water contents of the raw materials and allowance made therefor in weighing out the appropriate quantities of the different grades to ensure that their dry weights after evaporation of their water content by the heating on conversion of the mix will conform with the desired specification of the coated roadstone.

For the preparation of the cold mix, the binder in particulate or granulated form may be mixed directly in the requisite quantity into the undried graded and proportioned aggregate material. However, it is convenient to mix heat-liquefied binder into the aggregate material advantageously by spraying on, since bitumen for example is delivered in this form as a rule. The molten binder applied cools off on the cold aggregate material during the mixing process and solidifies finely divvided into particles or a granulate distributed in the aggregate material.

Surprisingly, it has been found advantageous to process aggregate material with a water content of 5 to 15% by weight, since it has appeared that thereby the coating of the aggregate material with the binder during conversion of the cold mix is promoted.

In converting the cold mix, it may be conveyed along a path while being mixed and being heated to raise its temperature to the temperature required for liquefaction of the binder at a region ahead of the end of the path and with the temperature of the mix increasing in the direction of feed beyond that region, thereby to produce hot coated roadstone at different temperatures withdrawable at different points between that region and the end of the path.

The process in its entirety, the preparation of the cold mix, and the preparation of coated roadstone from the cold mix, may each be carried out either as a batch process or as a continuous process.

Apparatus for carrying out the process of the invention may comprise, for preparation of the cold mix, supply and quantity-regulating devices for delivery and proportioning of the respective grades of the aggregate material having a water content and of the binder, and a mixer to receive the proportioned aggregate material and binder; and, for conversion of the cold mix, a heated mixer which is adapted to advance the introduced mix through the mixer to a discharge outlet of the mixer while increasing the temperature of the mix in the direction of propulsion.

Where liquefied binder is added to the aggregate material in the preparation of the cold mix, a heating device may be provided for melting the binder or for increasing its degree of liquefaction prior to supply to the mixer wherein mixing of the cold undried aggregate material with the binder is effected.

One form which the heated mixer for conversion of the cold mix may take comprises a drum rotatable on its axis and provided with an inlet opening at one end for receiving the cold mix and a discharge opening for discharge of hot coated roadstone at its other end, and fitted with mixer vanes arranged to advance the mix along the drum towards the discharge opening as the drum is rotated. In another form, the heated mixer may comprise a stationary (i.e. non-rotating) drum or trough containing a driven device such as a rotatable worm for advancing the mix along the drum or trough

It will be appreciated, since essentially the aggregate material is to be processed without first being dried, that no separate dryer therefor will be provided or present in apparatus for carrying out the process of the invention.

It will be apparent also from the foregoing that while the equipments respectively for preparing and for converting the cold mix may be installed together in one plant for carrying out the process of the invention in its entirety, they may be installed separately at different locations, for instance the conversion equipment only at a con-

struction site where coated roadstone ready for use is required, such being produced on site from a cold mix prepared by equipment elsewhere and supplied to the site.

It has proved especially advantageous to provide that the heated mixer for conversion of the cold mix is adapted to heat the mix to the temperature necessary for the liquefaction of the binder at a region in the mixer ahead of its discharge end, and to provide further discharge openings for tapping off hot coated roadstone between that region and the discharge end. This allows either the whole plant for carrying out the entire process, or the cold mix conversion equipment (in the case of production of the cold mix separately elsewhere), to be set up in a supply area for several construction sites, in order then to tap the hot coated roadstone being produced, in differently heated conditions to compensate for cooling in transit to site, having regard to the transport distances to the individual sites. In this way it is possible to tap from one and the same heated mixer different kinds of coated roadstone in a condition ready for application.

Cold mix conversion equipment may include an unheated pre-mixer driven independently of the heated mixer, for premixing the cold mix before it is fed to the heated mixer, the pre-mixer discharging into the heated mixer.

In order to illustrate the invention and a manner in which it may be carried into practice, reference will now be made to the accompanying diagrammatic drawing of an example of a plant for carrying out the process of the invention.

Referring to the drawing, the different grades of aggregate material having a water content drawn from store (which may be storage heaps exposed to the weather) are supplied to feed hoppers 1 from which the material is fed on to a conveyor belt 3 through quantity-regulating devices 2 by means of which the proportioning of the different grades fed to the belt 3 can be controlled. In practice these feed regulators 2 may be controlled from a remote control station. The belt 3 conveys the proportioned aggregate material to a scalping screen device 4 which removes oversize stone and rejects it as depicted at 5.

From the screen 4 a feed conveyor 6 delivers the aggregate material to a batch surge hopper 7 which discharges into a batch weigh hopper 8 by which the aggregate material is charged in precisely measured quantity into a batch mixer 9.

The batch mixer 9 also receives bituminous binder, either in the solid form of granulate or in molten form, added in appropriately regulated quantity. The drawing illustrates the addition of molten binder, for which purpose a heater 10 is depicted for melting the binder, or liquefying it more, whence the liquid binder is pumped by way of a conduit 11 to the batch mixer 9.

In the batch mixer 9 the aggregate material and the binder are thoroughly mixed. If molten binder is used it cools on the cold aggregate material, to become a finely divided granulate distributed in the mixture. Thus there is obtained as output of the batch mixer 9 a cold mix of proportioned aggregate material and binder. This resultant intermediate product is fed through a chute 12 to one end of a heated mixer 13 through which the mix is advanced (from left to right in the drawing) with progressively rising temperature to a discharge outlet of the mixer at its other end. In passage of the mix through the mixer the water contained in the aggregate material is evaporated and at the same time the binder is liquefied and coats the dried constituents of the aggregate material. Until such time as they are bound into the mix by the liquefied binder, the dusty constituents of the aggregate are retained by the water content.

The temperature in the mixer 13 can be set so that at least at its discharge end (the right-hand end in the drawing) the temperature is sufficiently high to have liquefied the binder and to produce hot coated roadstone in condition for application. It is, however, advantageous to ensure that the temperature necessary for the liquefaction of the binder is already present in a region of the mixer 13 ahead of its discharge end, and to provide between this region and that end suitably positioned discharge outlets 14 from which hot coated roadstone at different temperatures can be tapped.

In the illustrated example the entire process for the production of coated roadstone from the raw materials has been described, and apparatus therefor depicted in one installation. However, as already explained in the foregoing, the cold mix of aggregate material and binder is a product of manufacture in itself and may be produced as such, utilising that part of the depicted apparatus which is represented by the devices 1 to 11. Thus, the cold mix, constituting the output product obtained from the mixer 9, may be produced at one location, stored if necessary or desired, and transported to another location at which the heated mixer 13 (and if desired, an unheated pre-mixer) is provided for further processing of the received cold mix into coated roadstone ready for use

It will be appreciated that in a plant as depicted in the drawing the mixers 9 and 13 could be structurally combined in a single unit having an unheated charging section

which is constructed as a mixer to perform the function of mixer 9 and from which the mix is passed to a heated section performing the function of mixer 13.

WHAT WE CLAIM IS:—

1. A process for producing coated roadstone which comprises heating and mixing an aggregate material having a water content and a solid bituminous binder in particulate or granular form proportioned to provide a composition requisite for a mix coated roadstone to be produced, the water content being removed by evaporation at the same time as the binder is liquefied and coats the aggregate, and the dusty constituents of the aggregate material being retained until such time as they are bound into the mix by the liquefied binder

2. A process as claimed in claim 1, wherein the aggregate and binder are subjected to a preliminary cold mixing operation.

3. A process in accordance with any preceding claim, in which the aggregate material is pre-mixed with the binder, the latter being added in molten condition to the aggregate material which cools the binder to cause it to solidify.

4. A process in accordance with any one of the preceding claims in which the aggregate material has a water content of 5 to 15% by weight

5. A process in accordance with any preceding claim, in which the aggregate material and binder are conveyed along a path while being mixed and being heated, whereby the temperature of the mix so formed is raised to the temperature required for liquefaction of the binder at a region ahead of the end of the path and with the temperature of the mix increasing in the direction of feed beyond that region, thereby to produce hot coated roadstone at different temperatures withdrawable at different points between that region and the end of the path.

6. A process in accordance with any preceding claim substantially as hereinbefore described with reference to the accompanying drawing.

7. The product of the process claimed in any preceding claim.

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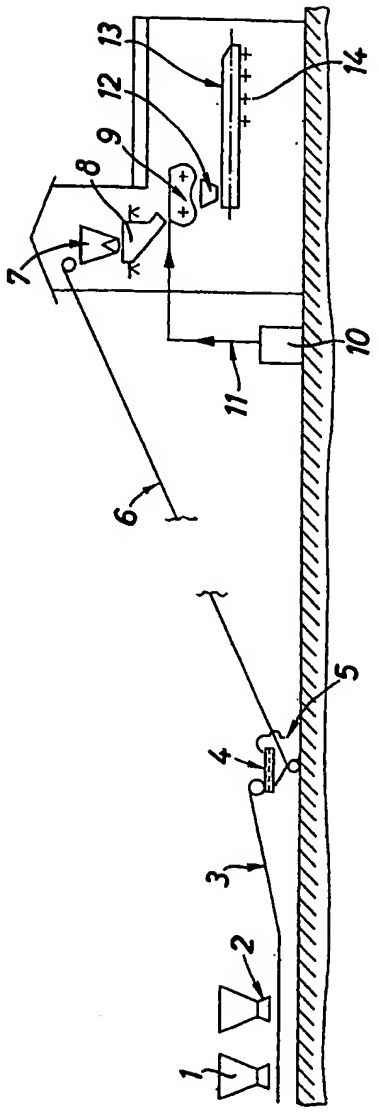

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This invention relates to coated roadstone

order to return them again to the dried aggregate material, as for compliance with regulations, to install relatively expensive equipment such as cyclone separators for the collection of entrained dust and fines emitted from the dryer.

An object of this invention is to provide an improved method of producing coated roadstone which avoids the described dis-

SPECIFICATION NO 1340762

By a direction given under Section 17 (1) of the Patents Act 1949 this application proceeded in the name of UNDERGROUND MINING MACHINERY LIMITED, a British company, of York House, Westminster Bridge Road, London SE1, and REDLAND ROADSTONE LIMITED, a British company, of Redland House, Reigate, Surrey.

THE PATENT OFFICE

R 74649/5

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However, the practice referred to has serious disadvantageous consequences. The drying of the aggregate releases dust and fines which are carried away with the current of drying air. Thus not only would initial proportioning and composition of the aggregate material be upset, but particularly those constituents would disappear which are required for filling voids between the coarser constituents to ensure a dense and stable road surface when the coated roadstone is laid Moreover, there is, of course the considerable problem of dust pollution and effective compliance with official regulations regarding such industrial emissions It is therefore necessary, as well for recovery of fines from the drying air in

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